PROPOSAL
FOR
CHARACTERIZATION OF SURFICIAL SOILS
AT.
ROCKY FLATS PLANT

Geosciences Division
Environmental Science and Engineering
Environmental Restoration Management
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EXECUTIVE SUMMARY

This proposal for soil characterization work is submitted in response to a request by DOE, RFO (correspondence ERD:JLP:00928). Samples of surficial soils from Rocky Flats Plant (RFP) will be collected from both presumed background locations and from potentially contaminated areas of RFP. The samples will be chemically analyzed for selected chemicals of interest. The resulting concentration data will be used to perform spatial analysis (using geostatistical methods) to identify geochemical gradients within the soils. The project will culminate in a report which will be distributed to DOE in November, 1994 (draft report) and March 1, 1995 (final report).

Spatial analysis will indicate if soil contamination originates from the central plant region (such as 903 Pad area) and impacts presumed background areas within the buffer zone. This is an important issue because background soil data are required for human health risk assessments and for negotiating reasonable cleanup goals.

Data from unimpacted samples will be used to compute background statistics (such as tolerance intervals) for surficial soils. Data from four major soil series will be compared. These soil series occur both in the operable units (OUs), and in background areas such as Rock Creek. This comparison will indicate the relative magnitudes of the differences in chemistry between soil series, versus differences between presumed background soils and OU soils.

About 10% of the soil samples will also be collected and analyzed for edaphic parameters to support biota sampling which has already been performed for the Environmental Evaluations (EEs).

JUSTIFICATION

This project has been requested by DOE, RFO and by the Colorado Department of Health (CDH) in recent correspondence (ERD:JLP:00928, ERD:JLP:00201, ERD:BKT:11059, ERD:BKT:11135). The work remedies perceived deficiencies in the area of soil characterization at Rocky Flats. It directly supports the IAG and CERCLA/RCRA investigations for all OUs. These soil data will support: (1) Human health risk assessments for the OUs; (2) The Background Geochemical Characterization Program; 3) Environmental evaluations; and 4) General site monitoring under DOE Order 5400.1. Concerns have been expressed by CDH that background surficial soils may not exist at RFP because of the potential for wind blown contamination. This soil study should help to validate the use of apparently unimpacted areas such as Rock Creek as background reference areas for soil contaminant investigations at Rocky Flats.

OBJECTIVES

The objectives of this study are to perform soil characterization work at RFP to better meet the on-going CERCLA/RCRA/IAG requirements. Specific objectives fall into two categories: perform spatial analysis to define geochemical trends, and collect data to support environmental evaluations. These are described below.

Spatial Analysis

Spatial analysis will be performed to identify geochemical gradients and ascertain the impact of RFP on the soil environment of the buffer zone. This analysis may also identify impacts on the buffer zone by nearby industry and highways. It will provide background or reference soil data for human health risk assessments.

Data from unimpacted samples may be used to compute background statistics for surficial soils. Data will be collected for four major soil series which occur both in the OUs and in presumed background areas to determine the relative magnitude of differences in chemistry between soil series, versus between background areas and OUs.

Environmental Evaluation Support

Edaphic parameters will be collected to aid the interpretation of ecological data previously collected for environmental evaluations, including: vegetation, small mammals and arthropods. This study will return to these EE sampling sites (both reference sites and potentially contaminated OU sites) to describe the soil profile and collect soil samples. The exact number and location of edaphic sampling sites will be described in the workplan. As a basis of estimate, this proposal assumes collection of 3 samples (A and B horizons and the base of the root zone) from approximately 20

sites. The edaphic data will not be evaluated as a part of the surficial soil report. Instead, these data will be provided to the Ecology and NEPA Division for use in environmental evaluations.

METHODS
Geostatistical Approach

The spatial variation in soil analyte concentrations will be described using geostatistical techniques (Kriging). Specifically, this investigation will make use of regionalized variable theory and semivariograms as demonstrated by the published work of Burgess and Webster (1980a, 1980b), Gilbert and Simpson (1985), and Webster and Oliver (1990).

A semivariogram describes the rate of change in a regionalized variable in a given direction, and the degree of spatial dependence between samples (EPA, 1988). It also partitions the total variance of a data set into two parts: random (or local) variance, and the intersample variance relative to the sample spacing. Kriging develops global and local estimates using the variography results to determine the best linear unbiased estimator. A detailed discussion of Kriging theory and its application to this investigation will be included in the workplan.

Sampling and Analysis Approach

The design of the sampling plan, the sampling protocol and analyte lists will be described in the project workplan and are not defined at this time. This proposal and preliminary cost estimate are based on the following assumptions.

* Where possible, existing sampling SOPs, health and safety plans and portions of workplans will be re-used or modified to save on project costs.

* All soil sampling locations will be surveyed, and the soils physically described by a qualified soil scientist.

* To support EEs, approximately 60 soil samples (20 locations times 3 sample depths) will be collected for edaphic parameters.

* Edaphic soil parameters to be described or analyzed will include: soil structure, texture, color, water retention capacity, depth of the horizons, depth of the solum, depth to free lime, bulk density, cation exchange capacity, extractable cations, extractable N, extractable P, total organic carbon (TOC), total kjeldahl nitrogen (TKN), percent saturation, pH, and conductivity.

* The analyte list for soil samples collected for EE support will be limited to edaphic parameters and will not include contaminants of concern to the OUs.

* The spatial study will sample from four soil series of potential importance to the OUs, and also found in background areas. The Soil Conservation Service map of the plant (SCS, 1980) denotes these as #31 Denver-Kutch-Midway clay loams, #45 Flatirons very cobbly sandy loam, #60 Haverson loam, and #100 Nederland very cobbly sandy loam.

* Approximately 200 surficial (top 5 cm) soil samples will be collected to provide adequate coverage for spatial analysis.

* Analyte suites and analytical methods for the spatial analysis portion of the study are intended to be comparable to soil data collected for RI/FS investigations within the OUs.

* Analytes for spatial analysis will include EPA target analyte list metals, a dozen isotope-specific radiochemicals, and the semivolatile organic compounds: bis-2-ethylhexyl phthallate, fluoranthene, and pyrene. We do not believe that it is cost effective to analyze for volatile organic compounds (VOCs) in the surficial soil environment because most of the analyses are expected to have non-detect concentrations of VOCs.

The reason for including bis-2-ethylhexyl phthallate is that it is one of the few semivolatile organic compounds (or BNA, for base, neutral, or acid extractable) commonly found in background stream sediments from Rock Creek. Table 5-214 of the Background Geochemical Characterization Report (EG&G, 1992) indicates that this BNA was detected above the reporting limit in 77% of the sediment analyses. This is the highest detection frequency for any semivolatile compound in background sediments.

Approximately a half dozen polyaromatic hydrocarbon (PAH) compounds are also found in background stream sediments. Fluoranthene and pyrene are representative of these PAHs and will be used as "indicators" of PAH contamination. They have high frequencies of detection (about 50% of samples). Table 5-214 sediment data suggest that approximately 50 other target compound list semivolatiles will normally be below detection and the data unusable for Kriging. Therefore it is probably not cost effective to analyze the full suite of BNAs for spatial analysis.

POTENTIAL SCOPE CHANGES

Project scope, cost, and schedule are dependent on the final project workplan and therefore are subject to change. For example, the project schedule (Figure 1) assumes a single phase study. If the workplan determines that it is better to perform a pilot study and then base the main investigation on the results of the pilot, the project timelines will have to be extended.

It is also anticipated that the results of this investigation may lead to a proposed extension of the project (during FY95). If DOE, RFO sends the final report to EPA and CDH, they may comment on it and request more data interpretation work, or request analysis of additional analyte suites. Scope increases are particularly likely if this study finds evidence of contamination of RFP origin in our areas which we have presumed to be background.

REFERENCES CITED

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Figure 1.   Schedule for Surficial Soil Characterization

Activities	1993 J F M A M J J A S O N D	1994 J F M A M J J A S O N D	1995 J F M A M J J

Activities:
1. Project Management
II. Write Draft Workplan
   Internal Review
   Write Final Workplan
III. Write Draft H&S Plan
   Internal Review
   Write Final H&S Plan
IV. & V. Field Work (i.e., Sample Collection, Shipping, and Surveying)
   Analytical Chemistry
   Data Validation & Database Entry
VI. Data Reduction and Reporting, First Draft
   Internal Review (Draft 1)
   Draft 2 Report (to DOE 11/15/94)
   DOE Review
   Final Report (to DOE 3/1/95)